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UPJOHN
POLYMER
CHEMICALS
DIVISION

Upjohn

papi[®]

RECOMMENDATIONS
FOR HANDLING AND STORAGE OF PAPI
AND RELATED POLYMERIC ISOCYANATES

TECHNICAL
BULLETIN - **102**



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TABLE
OF CONTENTS

<i>Subject</i>	<i>Page</i>
INTRODUCTION	1
TEMPERATURE AND MOISTURE CONTROL	2
STORAGE AND HANDLING FACILITIES	3-9
Notes for Detail Drawing of Bulk Storage Facility	4
Detail of Bulk Storage Facility (Figure I)	5
General Description of Dry Atmosphere Blanketing and Vent System	6
Notes for Tank Dry Atmosphere Blanketing and Vent System	6
Typical Tank Dry Atmosphere Blanketing and Vent System (Figure II)	7
Notes for Detail Drawing of Typical Vent Bubbler	8
Typical Vent Bubbler (Figure IIA)	9
UNLOADING PROCEDURES	10-14
Tank Cars	10
Detail of Tank Car Fittings (Figure III)	11
Tank Wagons	12
Detail of Tank Wagon Fittings (Figure IV)	13
Drums	14
CAUTION AND SAFETY PRECAUTIONS	15
EQUIPMENT TYPES AND SOURCES, TABLE V	16
TECHNICAL INFORMATION SHEET OF POLYMERICS APPLICABLE TO THIS BULLETIN	Attachments

INTRODUCTION

This bulletin is intended as a general guideline concerning PAPI® and the other related polymeric isocyanates as designated in the Technical Information sheets attached to this bulletin. More specific information concerning your particular circumstances can be had by contacting your local Upjohn representative. Where only the trade-name PAPI is used, it is understood to be applicable also for the other related products as specified in the attached Technical Information sheets. Where the Technical Information sheet of a specific product recommends temperature or handling considerations different than the general recommendations, the Technical Information sheet guidelines should be given priority.

PAPI is consistently manufactured to narrow specifications. To maintain this high quality and assure the manufacturer of reproducible products, basic precautions must be taken in the handling and storage of the isocyanate. When handled properly, PAPI presents no problems; however, recommended precautions must be observed to prevent contamination.

This bulletin concerns the following factors related to the handling and storage of PAPI; and related polymeric isocyanates.

1. Temperature and moisture control.
2. Construction materials for storage and handling facilities.
3. Unloading procedures for: Tank Cars—U.S.A.
Tank Wagons—U.S.A.
Drums

PAPI is shipped in tank cars, tank wagons, and 55-gallon (208 liter) non-returnable drums.

TEMPERATURE AND MOISTURE CONTROL

Heat and, to an even greater extent, water are the two factors likely to cause deterioration of PAPI®. It is, therefore, essential that PAPI be stored out of contact with water or moisture and that it be heated only under controlled conditions. Water reacts with many times its weight of PAPI to form carbon dioxide gas and insoluble ureas.

Although there is little danger of crystallization or separation on freezing for most polymeric isocyanates, there are some specific exceptions. Refer to Technical Information sheet for more complete precautions. Increased viscosity caused by low temperatures makes for difficult handling. For drum shipments that have been exposed to cold temperatures, slow heating to 90°F (32°C) is sufficient to lower viscosity to a normal level. Refer to Technical Information sheet of applicable product for exceptions.

Optimal storage temperature range is 70°F to 80°F (21°C to 27°C) with a maximum temperature of 90°F (32°C) for temporary or unusual conditions.

All outside transfer lines, storage tanks, tankwagons, and tank cars should be insulated and must be designed to allow heating with low pressure steam or warm water coils or jackets. Preferably, the coils should be on the exterior of the tanks to minimize the possibility of moisture leakage and to facilitate tank cleaning. Temperature wells or other means of temperature indicators should be installed so that it is possible to accurately monitor material temperatures.

Moisture, either as vapor or liquid, is the most probable source of isocyanate contamination. Storage under a dry non-reactive atmosphere at slight positive pressure to eliminate possibility of moisture contamination is imperative. When containers have been opened for either sampling, inspection, or partial withdrawal, the atmosphere above the isocyanate should be replaced with dry nitrogen or dry air with a maximum water content of 65 ppm (approximate dew point of -40°F (-40°C)). Carbon dioxide is not to be used because of its solubility in isocyanates. Lines leading from storage tanks should be plugged or capped to protect remaining PAPI from coming in contact with moisture.

Moisture contamination in PAPI produces carbon dioxide; to guard against build-up of excessive gas pressure in case of accidental contamination, all storage tanks must be equipped with pressure relief valves or safety rupture discs.

A protective skin resembling that which forms in an open container of oil paint will develop on PAPI that has been exposed to moisture. The liquid PAPI under the skin can generally be used without requiring a formulation adjustment, however, filtration is recommended.

CAUTION: With the use of inert gas, care must be exercised that oxygen deficiency (causing loss of consciousness) is not experienced during depressurizing, looking into a manway, tank entry, etc.

STORAGE
AND HANDLING
FACILITIES

Lined or unlined mild carbon steel is the recommended construction material for storage and/or transfer of PAPI®. Linings for mild carbon steel tanks can be of baked-on phenolic, epoxy, or urethane. Unlined mild carbon steel can cause trace iron contamination which may be detrimental to the processor's usage. Other satisfactory materials of construction are stainless steel, glass-lined steel, stainless- or nickel-clad steel, however, these materials are more expensive and do not provide any gain in performance unless a different future usage of the storage tank is contemplated. Aluminum and brass cannot be used in any place where contact with PAPI is possible.

Pumps, lines, and fittings can be of stainless steel, "Duriron" or mild steel. Mild steel pipe and equipment can result in iron contamination. Where flexible hoses must be used, "Viton" or "Teflon" is recommended. Pumps must have a mechanical seal due to normal leakage around stuffing boxes which can result in abrasive reaction products with subsequent shaft scoring. Valves for PAPI service should have minimum stem leakage to minimize possible reaction products binding and freeze-up. The most satisfactory results are obtained by using ball valves, butterfly valves, or plug cocks with "Teflon" self-lubricating seals. "Teflon" type packing is preferred for conventional valves with packing glands.

STORAGE AND HANDLING FACILITIES

Notes for Detail Drawing of Bulk Storage Facility

1. Typical vent bubbler—maintains positive pressure dry atmosphere on material for tanks situated inside a building this assembly should be mounted outside of building. See figure II-A for details.
2. Nozzles—level indicator, size 2" (50 mm).
- 2A. Level indicator—tank mounted sight glasses.
3. Manway—size 20" (500 mm); rating, API.
4. Nozzle—size 2" (50 mm).
5. Access ladder.
6. 13'-6" x 9'-0" (412 cm x 274 cm) LD tank—capacity, 860 cubic feet (24,350 liters), construction shell, bottom, and nozzles of carbon-steel; lined with epoxy, urethane or baked-on unmodified phenolic resin. All internal welds must be ground smooth before application of lining. Pressure test to 1.5 (0.1 ATM) psig of air with tank full of water. A stainless steel (type 304 or 316), glass lined steel, or stainless—or nickel-clad tank is more satisfactory, but more expensive.
7. Nozzle—roof mount; size 10" (254 mm). Can be utilized as mounting flange for top entry agitator.
8. Pressure relief system—relieves at 1 psig (51.7 mm Hg) pressure or 1 oz. (3.2 mm Hg) vacuum. For tanks situated inside a building, outlet of relief valve must be piped outside. See Figure II for details.
9. Nozzle—pressure relief; size 4" (100 mm).
10. Nozzle—venting and spare; size 2" (50 mm).
11. Piping—mild steel or stainless steel. **Caution:** Do not use aluminum or copper containing materials.
12. Insulation—as required to maintain PAPI® temperature between 60°F (16°C) and 90°F (32°C). Optimum storage temperature is between 70°F (21°C) and 80°F (27°C). Refer to product Technical Information sheet for exceptions requiring higher storage and/or maintenance temperature range.
13. Nozzle—temperature indicator; size 1" (25 mm).
14. Nozzle—sample connection.
15. Nozzle—outlet; size 3" (75 mm).
16. Drain.
17. Pump—capacity requirements for liquid specific gravity approximately 1.2 and absolute viscosity to 600 cp at 60°F (16°C).
18. Nozzle—temperature indicator.
19. Nozzle—pressure indicator.
20. Heat exchanger—required only if tank is to be subjected to ambient temperature below 50°F (10°C) for several hours. Exchanger design should be customized for each installation to give maximum satisfaction of performance. Tempered water is preferable for heating; however, saturated steam at a maximum of 5 psig (0.34 ATM) may be utilized. Refer to product Technical Information sheet for exceptions requiring higher minimum temperature protection.
21. Controller—temperature, indicating.
22. Filter—see attached listing of suppliers for recommended types.

Schematic for Typical Bulk Storage Facility

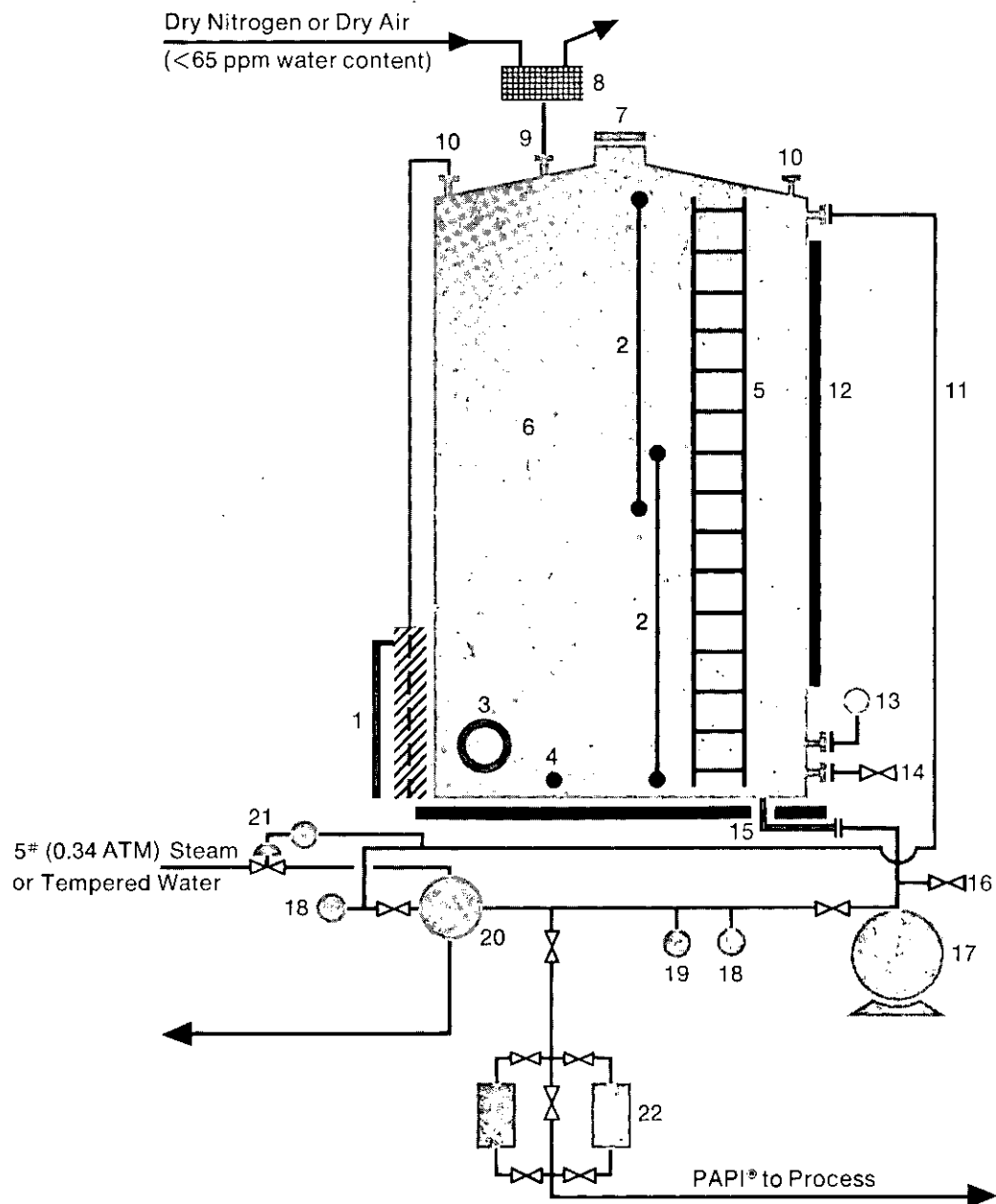
STORAGE
AND HANDLING
FACILITIES

Figure 1

STORAGE AND HANDLING FACILITIES

General Description of Typical Tank Dry Atmosphere Blanketing and Vent System

I. Dry Nitrogen or Dry Air Blanket

PRINCIPLE OF OPERATION — PROVIDES PRIMARY VACUUM RELIEF AT +0.1" (+2.5 mm) to 0.5" (12.7 mm) W.C.

The main valve, Item 4 (201P-3 regulator), is installed close coupled to the process or storage tank to eliminate all possible time lag of gas entry to the tank. On a decrease of pressure in the tank it relieves the pressure from the lower diaphragm casing. This causes the main valve to open, allowing gas to enter the tank. As pressure in the tank increases a buildup of gas pressure under the main valve diaphragm closes the valve.

FLOW CAPACITY OF SYSTEM IS 1780 SCFH (50.4 SCM/H)

Components

Item	Description	Function
4	201P-3 Regulator	Main valve reduces 5# (0.34 ATM) N ₂ to 3½" — 6½" (89-165 mm) W.C.
5	621 Regulator	Main regulator — reduces 130# (8.8 ATM) N ₂ to 5# (0.34 ATM)
6	Purge Meter	Controls and indicates flow of N ₂ to tank

II. Vent Bubbler (C)

Provides Primary Pressure Relief at 8" (201 mm) W.C. and back-up vacuum relief to prevent collapse of tank in cases of (A)/(B) failure. This assembly also acts as material overflow in cases of accidental overfilling of the tank.

III. Combination Pressure/Vacuum Safety Valve (B) = (A)

Provides secondary pressure relief at 14" (350 mm) W.C. and secondary vacuum relief at -0.9" (-23 mm) W.C.

Notes:

- A. Final venting should be outside of building on inside tanks.
- B. P/VSV; locate all instruments near ladder platform.
- C. Vent bubbler (refer Fig. II-A for more detail), entire vent bubbler should be mounted outside building on inside tanks.
- D. Vent bubbler line located minimum tank height with lowest point of atmosphere controls and P/VSV located at greatest clearance to prevent material contamination:
 1. Piping, and valves of line size ½ inch (12 mm).
 2. Piping, line size 1½ inch (40 mm).
 3. Piping, and valve of line size 2 inch (50 mm).
 4. Fisher control 201P-3 with 1½ inch body and orifice size ¾ inch, 3½ - 6½ inch (89-165 mm) W.C.
 5. Fisher control 621 with 1" body and ⅛" orifice, spring No. S 192, set for 10 psi (0.68 ATM).
 6. Flow indicating control, purge meter, 21 SCFH (0.59 SCM/H).
 7. Pressure gauge, 0-15 inch (0-380 mm) W.C. range.

NOTE: These materials based on 130 psig (8.8 ATM) source pressure, size of 1 and 5 must be varied with other pressures.

Tank Atmosphere Control and Vent System

STORAGE
AND HANDLING
FACILITIES

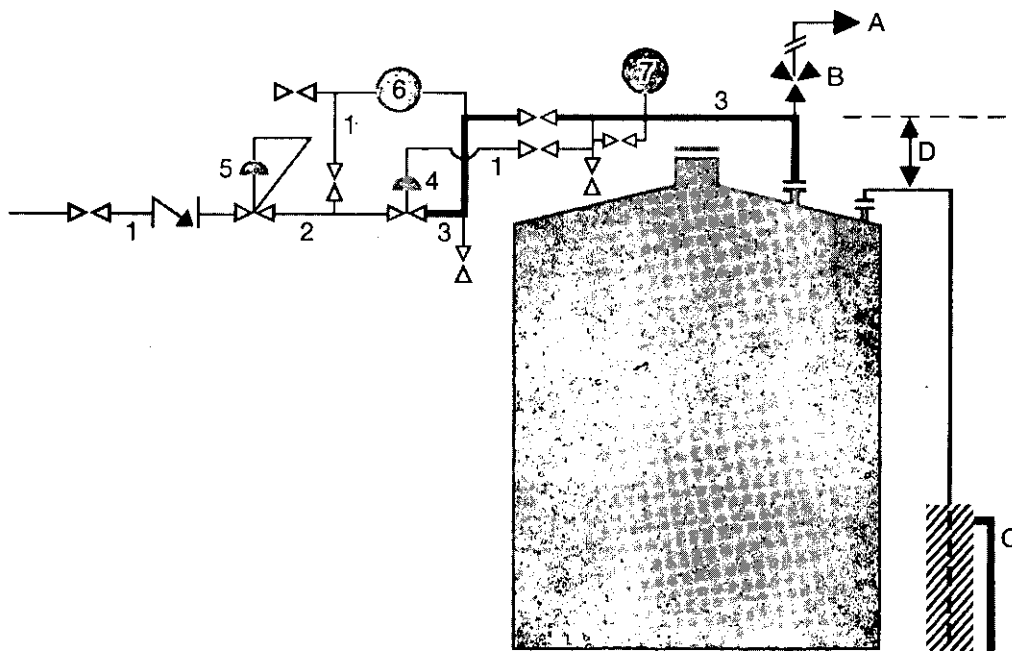


Figure II

STORAGE
AND HANDLING
FACILITIES

Notes for Detail Drawing of Typical Vent Bubbler

1. Pipe—2" (50 mm) standard weight.
2. Pipe—6" (150 mm) standard weight.
3. Pipe—fill system; 3" x 3/4" (75 x 20 mm) sch. 80, screwed reducer nipple.
4. Pipe—3/4" (20 mm) sch. 80.

Vent bubbler should have support brackets 1'-0" (305 mm) from top and bottom of Item 2. These can be anchored against wall of tanks outside of a building or may be separately anchored outside of a building on inside tanks.

Tank vent seal is filled to capacity of internal overflow with a suitable seal oil. Typical type oil is Humble-therm 500.*

Detail Drawing of Typical Vent Bubbler

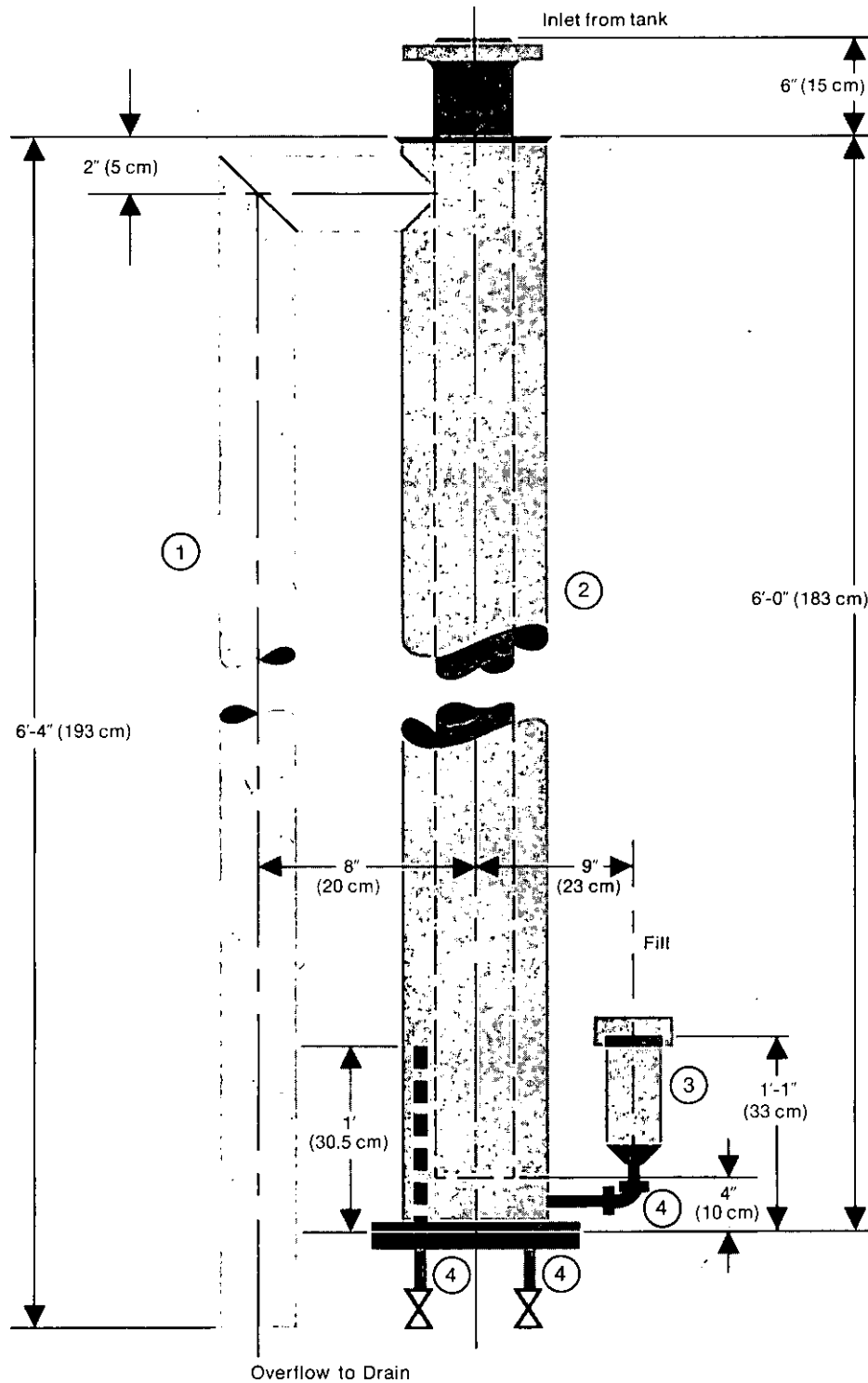
STORAGE
AND HANDLING
FACILITIES

Figure II-A

UNLOADING PROCEDURES (for U.S.A.)

Tank Cars (See detail of fittings in Figure III)

After car has been spotted in position, its hand brake set, and its wheels chocked, and "STOP-CAR CONNECTED" sign placed at head of car, check PAPI® temperature via thermometer leg to make sure it is above 50° F (10° C). (Refer to product Technical Information sheet concerning minimum temperature exception). If heating is required, connect low pressure steam (25 psig [1.7 ATM] maximum) or hot water to heating unit and raise temperature to 80° F-90° F (27° C-32° C) before proceeding with the following steps. **Note:** Cars are shipped pressurized with nitrogen, and caution should be exercised during opening of valves.

Sampling—

1. Assemble a set of fittings to the 1" valve on the sampling leg to form a goose-neck.
2. Apply a dry nitrogen or dry air pressure of 3 to 5 psig (0.20 to 0.34 ATM) to the car if necessary.
3. Open the 1" valve and flush approximately one gallon of PAPI to clear the leg, then withdraw the desired sample into a clean, dry container. Flush sample container with dry nitrogen or dry air before closing.

Unloading—

1. Check storage tank to be sure it will hold the full load.
2. The accepted method for properly removing plugs and/or making connections or disconnections, is to hold a "back-up" wrench on the body of the unloading outlet, nitrogen inlet or sample tube valve while making either the connection or disconnection of plugs or fittings. The same holds true for the removal of pipe plug or outlet nozzle cap from the outlet nozzle reducer.
3. Attach flexible unloading line to bottom unloading connection or, if preferred to top unloading line. If for safety reasons it is deemed advisable to depressure the tank car prior to making discharge connections, this may be done by removing the plug or cap from the pressurizing connection (No. 8) and then slowly opening the dry nitrogen or dry air inlet valve.
4. Connect pressure hose to 1 inch pressure line valve. Install a pressure gauge in the line close to the tank car.
5. Apply dry nitrogen or dry air to a maximum pressure of 30 psig (2 ATM).
6. Open valve on 2" unloading line.
7. When car is empty, the pressure gauge located near the car will show a drop in pressure and gas will release through the storage tank vent. At this point, close discharge valve and shut off pressurizing gas.
8. Leave inert gas pressure on car to preclude entrance of moisture; return car pressurized at between 5 and 10 psig (0.34 to 0.68 ATM).
9. Depressure and disconnect unloading and pressurizing lines.
10. Replace plugs, caps, and other fittings securely.
11. Blow out heating coils to prevent freezing in cold weather, leaving drain plugs open.
12. It is suggested that seals be placed on car dome, hatch and outlet valve.

If an unloading pump is used, the following procedure should be followed:

1. Check to be sure that bottom plug valve is closed.
2. Remove 2½" plug on bottom outlet and connect flexible unloading line.
3. Connect pressure line and gauge to 1" pressure valve.
4. Apply sufficient pressure to the car to prime the pump and maintain a flooded pump suction during unloading. Positive pressure must be maintained during discharge to prevent collapse of tank car.
5. When car is empty, blow lines and pump clean, then follow Steps 7, 8, 9, 10, 11, and 12 as previously described.

NOTE: It is imperative that a dry nitrogen or dry air purge with a moisture content of 65 ppm or less (dew point of -40° F or lower) be used if car is opened for any reason and that car be repressurized to 10 psig after closing.

UNLOADING
PROCEDURES
(for U.S.A.)

Detail of Tank Car Fittings

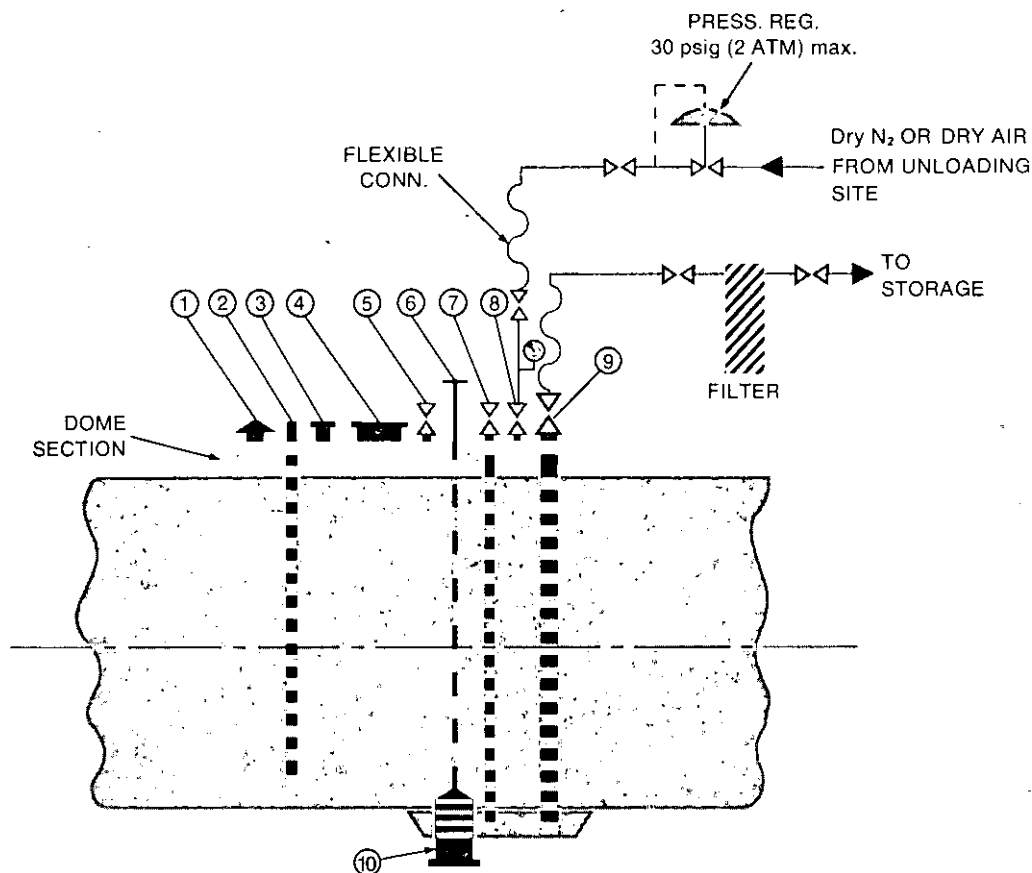


Figure III

Notes:

1. Pressure relief valve, 35 or 75 psig (2.4 or 5.1 ATM).
2. Thermometer well. $\frac{3}{4}$ " to 1" sealed pipe.
3. Car fill port (Do not open under any circumstances).
4. Manhole, 18", 20", or 22" diameter (Do not open. Notify shipper immediately if opened for any reason).
5. 1" Vent valve.
6. Hand wheel to operate bottom plug valve*.
7. 1" Sample leg, valve and plug.
8. 1" Pressure connection for dry nitrogen or dry air (water content 65 ppm or less).
9. 2" top-unloading line and valve (NPT female fitting).
10. 4" Capped pipe with 2 inch NPT outlet plug* for bottom unloading.

*Most cars are equipped with external flanged valve on the bottom connection of car.

CAUTION: With the use of inert gas, care must be exercised that oxygen deficiency (causing loss of consciousness) is not experienced during depressurizing, looking into a manway, tank entry, etc.

UNLOADING PROCEDURES (for U.S.A.)

Tank Wagons (See details of fittings in Figure IV)

Tank wagon shipments of PAPI® are delivered in insulated stainless steel tank wagons of 5500 gallons (20,820 liters) nominal capacity. Design of these tank wagons allows them to be bottom unloaded by pressure from the tractor/trailer air drier system. Pump unloading of Upjohn tank wagons is not permitted.

Check the tank wagon contents to be sure it is above 50° F (10° C). If the temperature is too low, connect low pressure steam (25 psig (1.7 ATM) max.) or hot water to the tank wagon heating connection. Raise the contents temperature to the 80° F to 90° F (27° C to 32° C) range before proceeding with the unloading. Refer to product Technical Information sheet for minimum temperature exceptions. On these product exceptions, the tank wagon is heated in transit by utilizing a tractor heated water source.

Unloading Procedure:

1. Gauge the storage tank to insure it will adequately receive entire tank wagon contents.
2. Unloading line must be clean and dry.
3. Connect the unloading line to the 2 inch bottom connection (2 inch "Kam-lock" fitting).
4. Tractor/trailer dry air system must be operating such that sufficient pressure to unload is maintained. (There is an emergency fitting on tank wagon so that unloading site air or nitrogen can be utilized through the drier system, however, this is only for emergency use in case of tank wagon air compressor failure).
5. To discharge contents, open the valve(s) on the 2 inch bottom connection.
6. Continue discharging until tank wagon is empty. The tank wagon pressure gauge will show a drop in pressure and the dry air atmosphere will release through the storage tank vent. The unloading hoses will normally quiver as the dry air is vented to the tank "blowing" the discharge lines clear of material.
7. Close the inner valve first and then the outer valve on the 2 inch bottom connection.
8. Do not shut off tractor/trailer dry air system. (If emergency unloading site air was used, pressurize tank wagon from 5 to 10 psig (0.34 to 0.68 ATM) and close off emergency connection valving so as to maintain that dry atmosphere during tank wagon return to shipper).
9. Depressure and disconnect the material unloading line and cap or plug the 2 inch discharge outlet on the tank wagon.
10. Where heating was utilized, purge the heating coils of water to prevent freezing in cold weather.

The tank wagon should not be cleaned by the receiver, neither should the manway be opened for inspection. The cleaning and inspection of the tank wagon is handled by the shipper on a routine basis under carefully controlled condition to safeguard personnel and equipment.

CAUTION: With the use of inert gas, care must be exercised that oxygen deficiency (causing loss of consciousness) is not experienced during depressurizing, looking into a manway, tank entry, etc.

Detail of Tank Wagon Fittings

UNLOADING
PROCEDURES
(for U.S.A.)

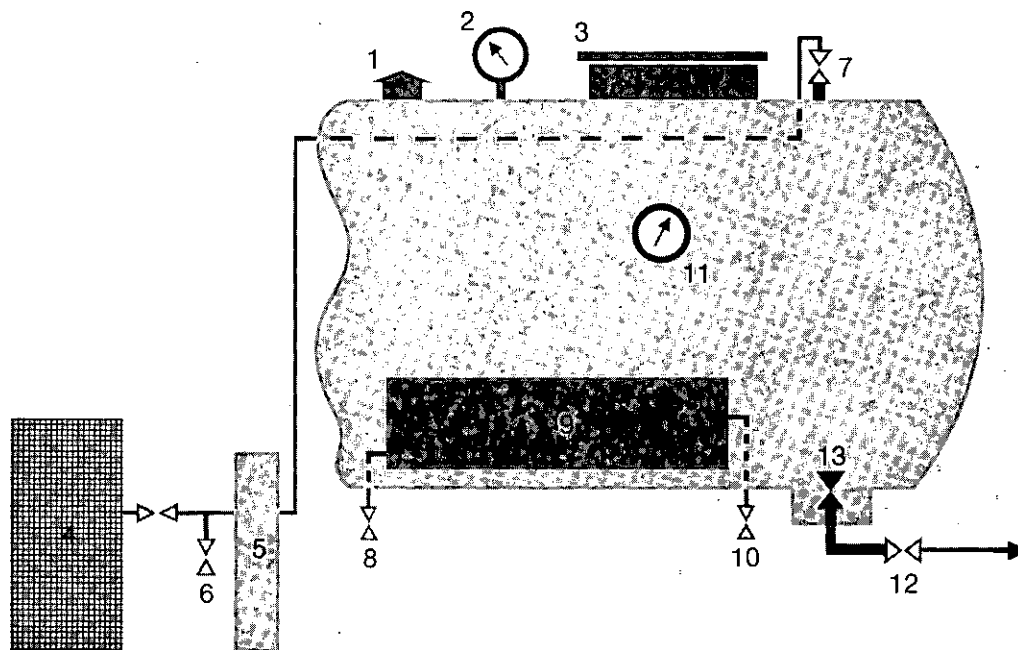


Figure IV

Notes:

1. Pressure safety valve, set to relieve at 30 psig (2.0 ATM) maximum.
2. Pressure gauge, 0 to 50 psig (0 to 3.4 ATM).
3. Manway, 20 inch.
4. Tank wagon air supply compressor (tractor mounted on some models).
5. "Drierite" air drier unit.
6. Auxiliary air input connection (emergency use only).
7. Tank wagon blocking valve on dry air system.
8. Input connection to external heating coils.
9. External heating coils/plates.
10. Outlet connection from external heating coils.
11. Thermometer, 0 to 120° F (— 18 to 49° C).
12. Bottom unloading connection, 2 inch valve and capped "Kamlock" fitting.
13. Internal remotely operated hydraulic block valve. (Some older tank wagons have a 2 inch external ball valve as a secondary shut-off point in lieu of internal hydraulic valve).

UNLOADING
PROCEDURES
(for U.S.A.)

Drums (for U.S.A.)

PAPI® is available in 55-gallon (208 liter) non-returnable drums with two bungs in the head, a 2" and a 3/4", respectively. During discharge of material from drums, the 3/4" vent should be equipped with a dry nitrogen or a dry air breather to avoid moisture contamination. Air driven or hand-operated pumps or ball valves are suitable for unloading PAPI drums. When not in use, the open end of the pump or valve must be protected with a plug or cap to avoid atmospheric moisture contamination.

Drums should not be pressurized for unloading.

Disposal of Empty Containers and Isocyanate Waste

Empty non-returnable isocyanate drums should be decontaminated by filling them with water, preferably outdoors, and allowing them to stand for 48 hours with the bung removed. UNDER NO CIRCUMSTANCES SHOULD THE DRUMS BE SEALED, STOPPERED OR CLOSED. Reaction of residual isocyanate with water generates carbon dioxide gas which could explosively rupture a sealed drum. After 48 hours, the drums should be drained and pierced to prevent reuse.

CAUTION: With the use of inert gas, care must be exercised that oxygen deficiency (causing loss of consciousness) is not experienced during depressurizing, looking into a manway, tank entry, etc.

WARNING!

SAFETY
PRECAUTIONS—
PAPI®, ISONATE®

Harmful if inhaled. Causes eye and skin irritation. May cause allergic respiratory reaction.

Avoid breathing vapor or mist. Use with adequate ventilation. **Avoid contact with eyes, skin and clothing.** Wear a mask or respirator of a type approved by the United States Bureau of Mines. If handled indoors, provide mechanical exhaust ventilation. During spray operations, air line masks or positive pressure hose masks should be worn because of the high concentration of isocyanate mist in the atmosphere. Wear clean rubber gloves, goggles, and clean waterproof or freshly laundered protective clothing (coveralls, rubber boots, cap, etc.). Destroy and replace gloves frequently.

If spilled, cover material with an oil absorbent composition (e.g., sawdust), sweep up and place in an open top container or onto a plastic sheet and treat with aqueous ammonium hydroxide. For disposal of this neutralized waste, bury or land fill: do not sewer into municipal systems.

FIRST AID PROCEDURE**Inhalation:**

Treat symptomatically. Remove to fresh air, and if necessary use vaso-dilators and oxygen. If reaction is extreme, call a physician.

Skin Contact:

Wash thoroughly with soap and water or rubbing alcohol.

Eye Contact:

Flush eyes with water for at least 15 minutes. Call a physician. (Complete safety and first aid literature is available on request).

CAUTION:

Polyurethanes or Polyisocyanurates produced from this product may present a fire hazard in certain applications if exposed to fire or excessive heat, e.g., welding and cutting torches, in the presence of oxygen or air.

For more detailed information on precautions for the proper usage of polyurethanes, polyisocyanurates and related materials, consult Upjohn Technical Bulletin 107 which describes safety in handling, toxicity, threshold limit values, physiological effects of inhalation and eye and skin contact, incompatibilities, and other essential information. Copies are available from Upjohn.

EQUIPMENT TYPES
AND SOURCES
(for U.S.A.)

Figure V

Item	Description	Source
Level Indicator	Liquid Level Gauge	Penberthy Co. Prophetstown, Ill. 61277
Tank Linings	Urethane	Hughson Chemical Co. Erie, Pa.
	Phenolic (baked on)	Napko Corp. 5300 Sunrise St. Houston, Texas 77021
	Epoxy	Napko Corp. Ameron Corrosion Control Brra, California 92621 Plas Chem Corp. St. Louis, Missouri 16501
Agitators	Roof Mounted, Overhung Shaft Design	Mixing Equipment Co., Inc. Rochester, N.Y. 14603 Chemineer, Inc. Dayton, Ohio 45401 Philadelphia Mixers Corp. King of Prussia, Pa. 19406
Gas Regulators	Atmosphere Blanketing and Vent Controls	Fisher Controls Marshalltown, Iowa 22508
Insulation	Tank/Pipe Insulation	CPR Division, The Upjohn Co.
Pump	Gear or Centrifugal	Duriron Co. Kettering, Ohio 45439 Worthington Standard Pump Corp. Harrison, N.J. 07029 Viking Pumps Cedar Falls, Iowa 50613
Pump Seal	John Crane "single inside, single spring" type 9MT-Code QP 191 (or equal)	John Crane Packing Co. Morton Grove, Illinois 60053
	Equivalent Type Substitute	Durametallic Corp. Kalamazoo, Michigan 49001
Heat Exchanger	Shell & Tube (BEM)	Any Reliable Vendor

"Duriron" is product trademark of Duriron Manufacturing Company.

"Teflon" is product trademark of E. I. DuPont De Nemours and Company.

"Viton" is product trademark of E. I. DuPont De Nemours and Company.

"Kamlock" is product trademark of Dover Corporation/OPW Division.

"Drierite" is product trademark of W. A. Hammond Drierite Company.

Figure V

EQUIPMENT TYPES
AND SOURCES
(for U.S.A.)

Item	Description	Source
Temperature Controller	Fischer & Porter 1451 100-200°F (37-93°C) Range	Fischer & Porter Co. Warminster, Pa. 18974
	Foxboro 43A	Foxboro Company Foxboro, Mass. 02035
Filters	Cuno Type D-CCF-F	AMF Cuno Div. AMF Inc. Meriden, Conn. 06450
	Velcon® Type FO-629FG-25B FO-614PLF-25	Velcon Filter Inc. San Jose, California 95112
Flex Hoses	"Viton®" Lined Hoses	Goodyear Trenton, N.J. 08604
		Gates Denver, Colorado 80217
Valves	Non-lubricated Plug Valve, "Teflon®" sleeve	Duriron Co., Inc. Kettering, Ohio 45439 Tufline Valve Div. Continental Manufacturing Co. Cincinnati, Ohio 45242
	Ball valves with "Teflon®" seats	Mills-McCanna 400 Maple Ave. Carpentersville, Ill. 60119
	Butterfly valves with "Viton®" or "Teflon®" seats	WECO P. O. Box 19465 Houston, Texas 77024
Gaskets	Crane Type 888	John Crane Packing Co. Morton Grove, Illinois 60053
Driers	Drierite® Type	W. A. Hammond Drierite Co. Xenia, Ohio 45385
	Activated Alumina Type	Pall Trinity Micro Corp. Cortland, N.Y. 13045
	Silica Gel Type	Kahn & Co., Inc. Wetherfield, Conn. 06109 Lectrodryer Division Ajax Magnethermic Corp. Pittsburgh, Pa. 15205

NOTES

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